(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 111 459
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 83830245.3

(51) Int. Cl.³: F 28 F 3/02

(22) Date of filing: 02.12.83

(30) Priority: 03.12.82 IT 956482

(43) Date of publication of application:
20.06.84 Bulletin 84/25

(84) Designated Contracting States:
AT CH DE FR GB LI SE

(71) Applicant: Pucci, Tamara
Via della Costituente, 23
Gambassi Terme Florence(IT)

(71) Applicant: Mandorlini, Oretta
Via Marconi, 9
Castelfiorentino Florence(IT)

(72) Inventor: Pucci, Tamara
Via della Costituente, 23
Gambassi Terme Florence(IT)

(72) Inventor: Mandorlini, Oretta
Via Marconi, 9
Castelfiorentino Florence(IT)

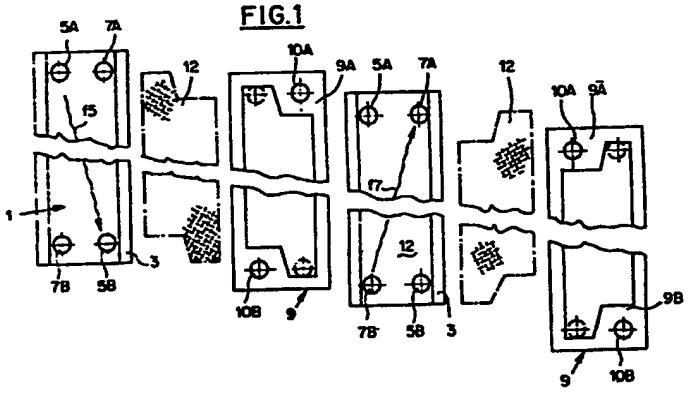
(74) Representative: Bardini, Marco Luigi et al,
c/o Società Italiana Brevetti S.p.A. Corso del Tintori 25
I-50122 Firenze(IT)

(54) **Plate heat exchanger.**

(57) A plate-type heat exchanger, wherein, to induce turbulent flow condition in the circulating fluids, instead of the known, expensive corrugated plates, flat plates (1) are used in combination with discontinuous baffles (12) interposed between two contiguous plates. In particular, the discontinuous baffle (12) consists of a metal wire-net that, after mounting, is partly in contact with the surfaces of two facing plates. The plate-type exchanger according to the invention is appreciably less expensive than the corresponding presently available plate-type exchangers.

EP 0 111 459 A2

FIG.1



PUCCI Tamara
MANDORLINI Oretta

"Plate heat exchanger"

The present invention refers, in general, to heat exchanger apparatus for heat transfer, and more in particular it refers to an improved plate-type exchanger.

As is known, plate-type exchangers are composed of a series of parallel plates held firmly together between substantial head frames. The plates are one-piece pressings, frequently of stainless steel, and are spaced by rubber sealing gaskets cemented into a channel around the edge of each plate. Each plate has a number of troughs pressed out at right angles to the direction of flow and arranged so that they interlink with each other to form a channel of constantly changing direction and section. The gap between adjacent plates is normally quite small. The hot fluid and the cold fluid flow in alternate spaces and a large surface can be obtained in a small volume.

The plate-type exchangers are, as is known, quite costly; this mainly depends on the expensive processing required

to produce corrugated plates.

The purpose of the present invention is to provide a plate-type exchanger that, being equal heat duty, pressure drops and other mechanical features, is characterized by a lesser cost than those presently available.

According to the invention, a heat exchanger with a fluid which must absorb calories or frigories - comprising at least two plates set apart to define an interspace into which the fluid is channelled, with gaskets or seals which delimit the interspace and with openings to provide passages for the circulating fluid - is characterized by the fact that the plates are flat and that a discontinuous baffle is set between the plates in the interspace to induce a certain turbulence in the flow. Said discontinuous baffle advantageously consists of a screen element, in particular metallic. Said screen element is in contact with the facing surfaces of the adjacent plates which define the interspace where said element is housed, said element being shaped like the internal perimeter of the gasket.

The baffle can in practice be of woven wire net, in particular metallic, or of stretched metal sheet, or be of any other suitable material.

The discontinuous baffle is replaceable and can be made of more or less closely-woven netting in order to create the desired pressure drop in the flow of fluid in the interspace.

The exchanger can have multiple interspaces for liquids heat exchange, or have a single interspace which may be part of a solar energy panel, or other.

Other characteristics, as well as the advantages, of

the plate-type heat exchanger according to the invention will be apparent from the following description of a preferred, non-limiting embodiment made with reference to the appended drawings, in which:

Fig. 1 shows an exploded front view of the components; Figs. 2 and 3 show local horizontal and vertical sections made with planes perpendicular to that of Fig. 1.

With reference to the drawings, a heat exchanger for liquids, of the stacked plate type, comprises flat plates 1 simply sheared off, indicated in particular as 1, instead of corrugated plates used with the known plate-type exchangers. These plates are clearly less expensive (with regard to the equipment for their production) than the pressed corrugated plates. In addition, flat plates 1 can be made of less expensive materials. The plates may be completed with rigid spacers 3, in order to assure tightening with a fixed spacing between the plates. In this way the reaction to the tightening is not exclusively left to the gaskets. The plates 1 are provided with openings for the circulation of the liquid, usually in counter-corrent. In particular, diagonally opposed openings 5A and 5B are provided for the first fluid and diagonally opposed openings 7A and 7B are provided for the second fluid. Sheared-off, flat elastic gaskets, indicated generally at 9, are placed between contiguous plates, besides the spacers 3 (if any). All gaskets 9 have the same shape, but are employed with alternate positioning: that is, each gasket is turned over with respect to the continguous ones in the stack of plates. Gaskets 9 have a substantially annular shape corresponding to the perimetrical edge of plates 1 and internal expansions 9A, 9B are formed in correspondence of two diagonally opposed angles. Holes 10A, 10B are formed through expansions 9A, 9B. When gasket 9 is placed between a pair of plates 1, holes 10A and

10B will correspond to the pair of holes 5A, 5B or to the pair of holes 7A, 7B, depending on the orientation of the gasket. The pair of holes of the plate not in correspondence to holes 10A, 10B communicate with the space circumscribed by the gasket forming the interspace between the two plates between which the gasket is set and held in place. Thus, in a stack of plates in which the gaskets between the plates are alternatively placed in one or the other of the two reversed positions, the interspaces between the plates will communicate alternatively with the line of holes 5A and holes 5B, and, respectively, with the line of holes 7A and holes 7B; thus, alternatively, the heating fluid (for example) flows through the even-numbered interspaces from hole 5A to hole 5B, as indicated by arrows f5 in Fig. 1, while the other fluid flows through the odd-numbered interspaces from hole 7B to 7A according to the arrows f7 in counter- and cross-current.

The interspaces, defined by the continguous plates 1 with a width equal to the thickness of the above mentioned spacers 3 or equal to the residual thickness of the gaskets 9 compressed when coupling plates 1 (the gaskets 9 will always be compressed, even in the presence of spacers 3), are partially filled with discontinuous baffles which have the following functions: creating turbulence in the flow of liquid in the interspace itself; assuring support and distancing between the central areas of the contiguous plates, in order to maintain uniform widths; and increasing the heat transmission with the plates. These non-continuous elements are, in practice, formed by metal wire-nets elements 12 having a shape corresponding to the space defined by the internal perimeter of gaskets 9; these elements are in contact with the plates 1 in order to assure an equal interspace between them and also to provide heat transfer by conduction between the fluid flowing through the wire-

net and the plates with which the wire-net is in contact. When the fluid encounters the wire-net 12 in the inter-space, the passage to turbulent flow conditions occurs in the fluid, these conditions being advisable, as well known, for the most effective heat transfer.

By modifying the type of wire-net used and, in particular, by using more or less closely-woven netting and/or made of more or less thick wires, the pressure drop in the internal circuits of the above-described plate-type heat exchanger can be modified; this can be useful to obtain particular performance characteristics of the exchanger.

Due to the presence of a plurality of spaced support points, provided by the wire-net elements 12, the thick-ness of the plates can be reduced with an appreciable reduction in weight, dimensions and costs. Anyway it is possible to use a type of plate which is more eco-nomical and easier to procure than those necessary for pressing.

The flat conformation of the plate results in lesser dimensions for the exchangers according to the invention in comparison to known plate-type exchangers, pressure drop being equal, or, respectively, dimensions being equal, this feature results in a lesser pressure drop.

The presence of spacers 3 avoids excessive compression of the gaskets, which instead remain compressed in the conditions best suited to assuring the seal, when the stack of plates is tightened down with the rigid spacers 3 in place, therefore not requiring a calibrated tigh-tening.

It should be understtod that the drawing shows only a practical embodiment of the invention and that various modifications can be made to it, without departing from

the scope of the invention itself. A heat exchange device, arranged in a similar way to that previously described, may be used, for instance, in the construction of solar energy panels to induce turbulence in the fluid circulating in the exposed interspace, defined by a flat plate that may be further equipped with flow diverters and/or means for creating a labyrinth.

The metal wire-net elements can be formed in various dimensions without incurring high equipment costs, and the plates themselves are cut in the desired dimensions without the use of either pressing or costly materials.

CLAIMS

1. A heat exchanger with a fluid which must absorb calories or frigories, comprising at least a pair of spaced apart plates to define an interspace through which said fluid flows, with gaskets or seals delimiting the interspace and with holes for creating passages for the circulating fluid, characterized by the fact that the plates are flat and that a discontinuous baffles is interposed therebetween in the interspace, in order to induce turbulent flow conditions in the fluid.

2. A heat exchanger according to claim 1, wherein said discontinuous baffle is constituted by a screen element, in particular metallic.

3. A heat exchanger according to claim 2, wherein said screen element is in contact with the facing surfaces of the contiguous plates which define the interspace where said element is arranged, said element being shaped so as to match the internal perimeter of the gasket.

4. A heat exchanger according to claim 1, wherein said discontinuous baffle is in woven wire-net, in particular metallic.

5. A heat exchanger according to claim 1, wherein said discontinuous baffle is replaceable and constructed with larger or smaller netting in order to create the desired pressure drops in the fluid flow in the interspace.

6. A heat exchanger according to claim 1, comprising a plurality of spaced plates defining interspaces through which two fluids flow in heat exchange relation, with gaskets delimitating the interspaces and with holes in the plates to create the passages for the circulating

fluids, wherein the plates in the stack are flat and discontinuous baffles are arranged between the plates in the interspaces.

7. A heat exchanger according to claim 1, that is part of a solar energy panel.

0111459

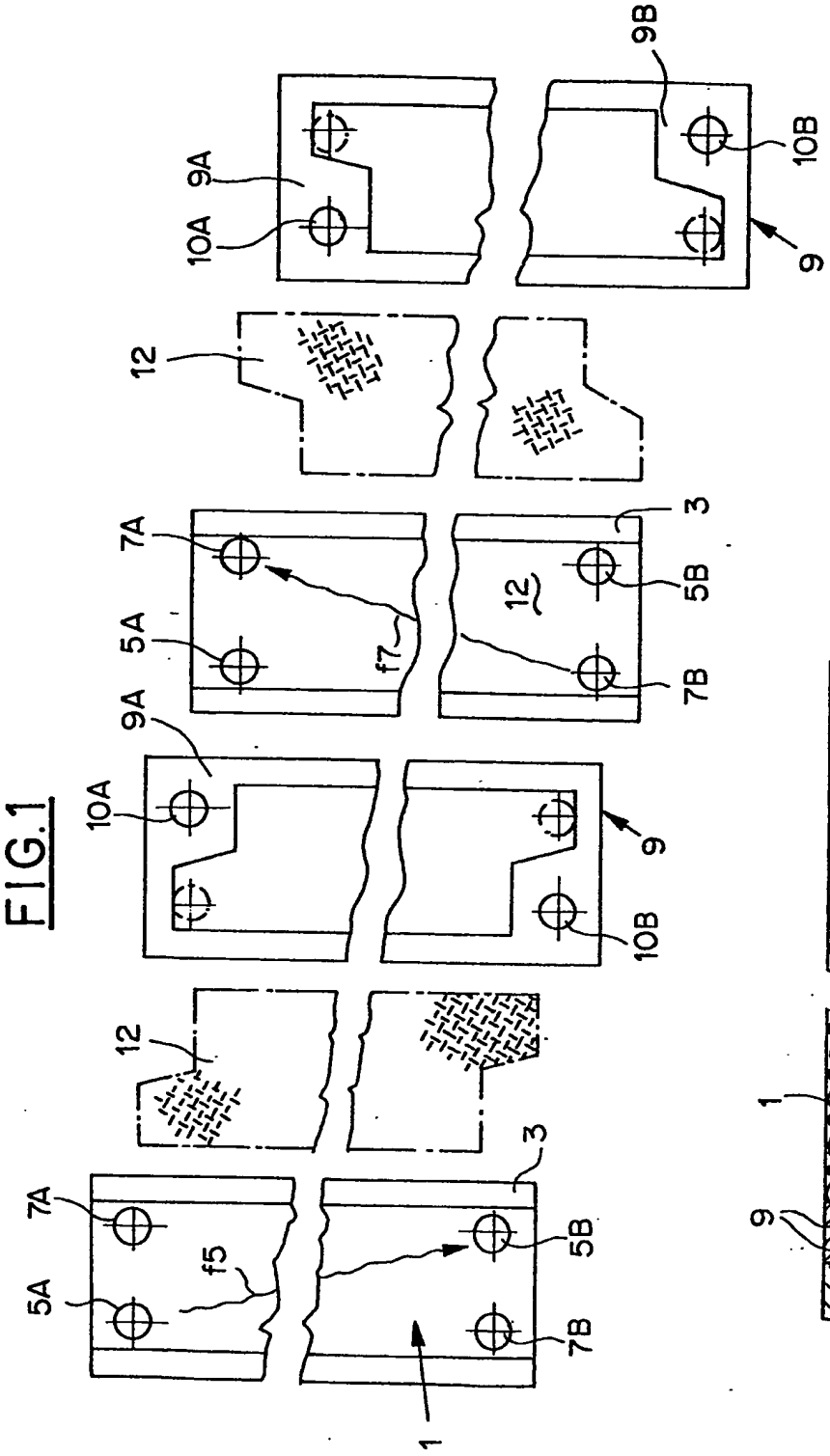


FIG.1

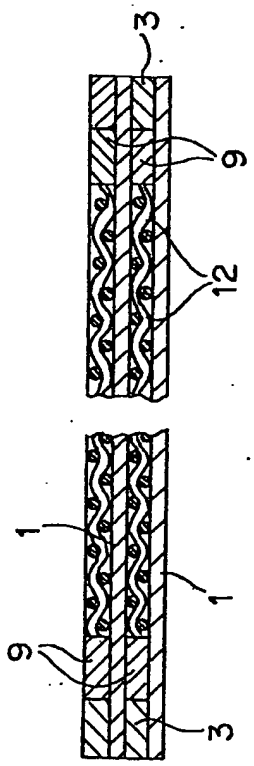


FIG.2

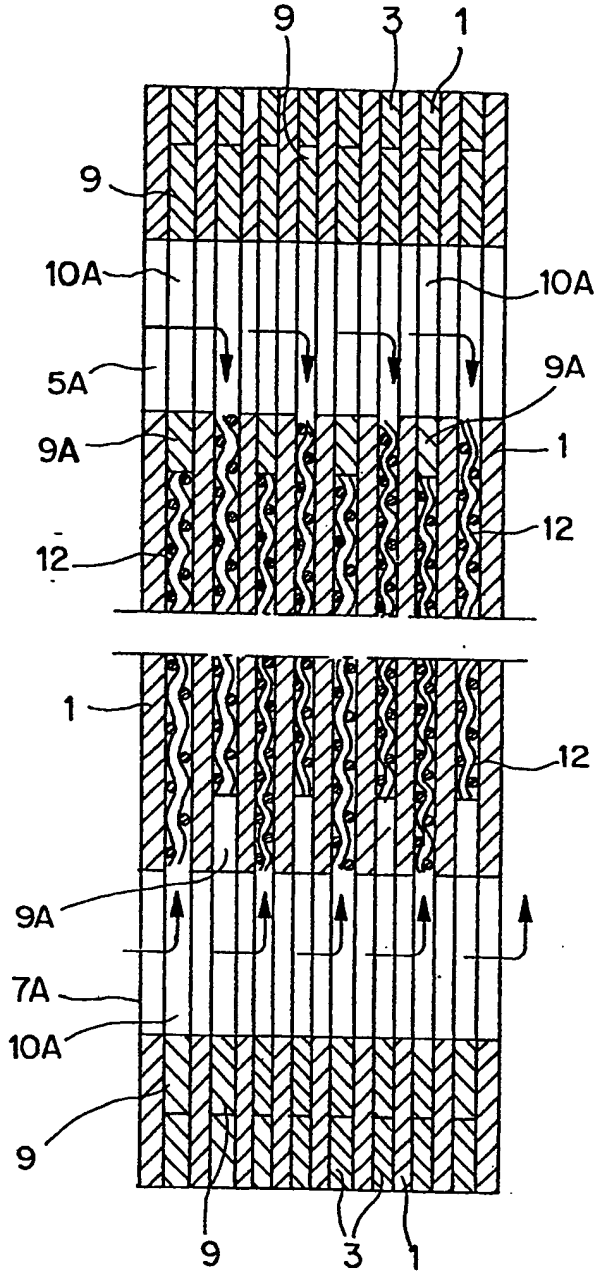


FIG.3